P P SAVANI UNIVERSITY

Third Semester of B. Tech. Examination

Nov-Dec 2021

SESH2011 Differential Equations

03.12.2021, Friday **Time: 09:00 a.m. To 11:30 a.m.** **Maximum Marks: 60**

Instructions:

1. The question paper comprises of two sections.
2. Section I and II must be attempted in separate answer sheets.
3. Make suitable assumptions and draw neat figures wherever required.
4. Use of scientific calculator is allowed.

SECTION – I

Answer the Following: (Any Six)

Q - 1	Solve $y\log y\,dx + (x - \log y)dy = 0$.	[05]
Q - 2	Solve $\frac{dr}{d\theta} = r\tan\theta - \frac{r^2}{\cos\theta}$.	[05]
Q - 3	Using the method of variation of parameters, solve $(D^2 - 2D + 2)y = e^x \tan x$.	[05]
Q - 4	Solve $\frac{\partial^2 z}{\partial x \partial y} = \sin x \sin y$, given that $\frac{\partial z}{\partial y} = -2\sin y$ when $x = 0$ and $z = 0$, when y is an odd multiple of $\frac{\pi}{2}$.	[05]
Q - 5	Solve $(D^2 - 2DD' + D'^2)z = \tan(y + x)$.	[05]
Q - 6	Solve $(y + z)p + (z + x)q = x + y$.	[05]
Q - 7	Solve $\frac{\partial u}{\partial x} + \frac{\partial u}{\partial y} = 2(x + y)u$ by the method of separation of variables.	[05]
Q - 8	Find the orthogonal trajectories of the family of semicubical parabolas $ay^2 = x^3$.	[05]
Q - 9	Solve the equation $\frac{\partial u}{\partial t} = \frac{\partial^2 u}{\partial x^2}$ with boundary conditions $u(x,0) = 3\sin n\pi x$, $u(0,t) = 0$ and $u(1,t) = 0$, where $0 < x < 1, t > 0$.	[05]

SECTION – II

Answer the Following: (Any Six)

Q - 1	Find the Laplace transform of $\{3t^5 - 2t^4 + 4e^{-5t}\}e^{2t}$.	[05]
Q - 2	Evaluate $L(\log(1 + \frac{1}{s^2}))$.	[05]
Q - 3	Evaluate $L^{-1}\left(\frac{s+7}{s^2+2s+2}\right)$.	[05]
Q - 4	Solve $y'' + 2y'y = 6te^{-1}, y(0) = y'(0) = 0$ using Laplace transform.	[05]
Q - 5	Find the Fourier series to represent $f(x) = e^{ax}$ in the interval $-\pi < x < \pi$.	[05]
Q - 6	Expand $f(x) = x\sin x$ as a Fourier series in the interval $0 < x < 2\pi$.	[05]
Q - 7	Using Fourier cosine integral representation of an appropriate function, show that $$\int_0^\infty \frac{cos\omega x}{k^2 + \omega^2} d\omega = \frac{\pi e^{-kx}}{2k}$$	[05]
Q - 8	Find the solution of the differential equation $y' - 2y = H(t)e^{-2t}, -\infty < t < \infty$ using Fourier transforms, where $H(t) = u_0(t)$ is the unit step function.	[05]
Q - 9	Find the Fourier series of $f(x) = x + x^2$ in $(-1,1)$.	[05]

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